

## REMARKS

Claims 1-13 are pending in the application, with Claims 1 and 7 being the independent claims. Claims 1 and 7 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Dent (U.S. Patent No. 5,894,473) in view of Vihriala (U.S. Patent Application Publication No. 2002/0045433 A1).

Applicants appreciate the indication by the Examiner that Claims 2-6 and 8-13 are objected to as being dependent upon a rejected base claim but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The Examiner concedes that Dent does not disclose calculating a frequency offset of the input signal and compensating for that frequency offset, relies on Vihriala for this deficiency, and asserts that it would have been obvious to combine the method and apparatus of Vihriala into the receiver of Dent.

The present invention relates to compensating for a frequency offset between a transmission signal and a reception signal for a user in an interleaved frequency division multiple access system. Claims 1 and 7 recite, in part, estimating the frequency offset from a selection signal, estimating multiple access interferences, and subtracting the estimated multiple access interferences.

Dent describes a multiple access communication system and method using code and time division. Vihriala describes a method and arrangement for reducing frequency offset in a radio receiver. Initially, it is noted Dent and Vihriala are both directed to Code Division Multiple Access (CDMA) communication systems, and both suggest application of their inventions to a Time Division Multiple Access (TDMA) communication system. In contrast, the present invention is related to compensating for a frequency offset

between a transmission signal and a reception signal in an interleaved frequency division multiple access (IFDMA) system.

Neither Dent nor Vihriala teach or reasonably suggest applying their inventions to an IFDMA system. In contrast to TDMA and CDMA, an IFDMA system is assigned a different set of orthogonal subcarriers. An IFDMA system differs from a CDMA system because no spreading sequence is necessary for the discrimination of the different user signals. An IFDMA system differs from a TDMA system because a continuous transmission is used.

Furthermore, the Examiner relies solely on Vihriala for teaching the method and apparatus for compensating for a frequency offset between a transmission signal and a reception signal according to the present invention. Vihriala monitors the phase of a channel estimation output and generates a complex phasor on the basis of successive phase values. The received baseband signal is then multiplied by the generated complex phasor for compensating the frequency offset. The frequency compensation can be made before or after the channel estimation thus producing a feedback compensation or feedforward compensation. In case of receiving a spread spectrum signal the feedback compensation can be implemented by compensating the baseband signal either prior to the despreading or after the despreading. In case of a rake receiver the frequency offset can be estimated from several channel estimates.

The frequency offset in an IFDMA system decreases a signal-to-noise ratio (SNR) by changing the magnitude and phase of a signal that is transmitted from a transmitter to a receiver and creates interferences among users. The typical way to minimize a frequency offset in IFDMA systems is to use very sophisticated analog RF/IF in the transmitter and the receiver of an IFDMA system.

The present invention provides a method and apparatus for compensating for a frequency offset between a transmission signal and a reception signal for a  $u^{\text{th}}$  user

( $1 \leq u \leq U$ , where  $U$  denotes the number of users) in an interleaved frequency division multiple access system. The method and apparatus estimate the frequency offset from a selection signal that is determined as the reception signal for the  $u^{\text{th}}$  user in an initial mode and as a feedback signal in a normal mode, estimate multiple access interferences representing an extent to which reception signals for  $i^{\text{th}}$  other users ( $1 \leq i \leq U-1$ ) at the same time interfere with the reception signal for the  $u^{\text{th}}$  user, subtract the estimated multiple access interferences from the reception signal for the  $u^{\text{th}}$  user and determines the subtraction result as the feedback signal, determines whether the previous three steps have been repeated a predetermined number of times, and if it is determined that the previous three steps have not been repeated the predetermined number of times, goes back to the first step, and if it is determined that the previous steps have been repeated the predetermined number of times, estimates the transmission signal for the  $u^{\text{th}}$  user using the feedback signal finally determined in the third step and the estimated frequency offset.

The method and apparatus for compensating for the frequency offset in an IFDMA system according to the present invention can remove the amplitude and phase distortions of a reception signal caused by an existing frequency offset and interferences among users in a base band instead of removing the frequency offset. Therefore, the cost for designing and realizing circuits can be reduced and the frequency offset can be compensated for before estimating the characteristics of channels.

Dent, Vihriala, or any combination thereof, fail to teach or reasonably suggest a method and apparatus for compensating for a frequency offset between a transmission signal and a reception signal for a  $u^{\text{th}}$  user ( $1 \leq u \leq U$ , where  $U$  denotes the number of users) in an interleaved frequency division multiple access system, where the method includes the steps of: (a) estimating the frequency offset from a selection signal that is determined as the reception signal for the  $u^{\text{th}}$  user in an initial mode and as a feedback signal in a normal mode; (b) estimating multiple access interferences representing an extent to which reception signals for  $i^{\text{th}}$  other users ( $1 \leq i \leq U-1$ ) at the same time interfere with the reception

signal for the u<sup>th</sup> user; (c) subtracting the estimated multiple access interferences from the reception signal for the u<sup>th</sup> user and determining the subtraction result as the feedback signal; (d) determining whether steps (a), (b), and (c) have been repeated a predetermined number of times, and if it is determined that steps (a), (b), and (c) have not been repeated the predetermined number of times, going back to step (a); and (e) if it is determined that steps (a), (b), and (c) have been repeated the predetermined number of times, estimating the transmission signal for the u<sup>th</sup> user using the feedback signal finally determined in step (c) and the estimated frequency offset.

Therefore, Claims 1 and 7 are allowable over Dent, Vihriala, or any combination thereof.

Accordingly, all of the claims pending in the Application, namely, Claims 1-13, are in condition for allowance. Should the Examiner believe that a telephone conference or personal interview would facilitate resolution of any remaining matters, the Examiner may contact Applicants' attorney at the number given below.

Respectfully submitted



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